3.B.2.b(6)(i)

vi. Exhaust fans may require interlocking with the supply fans to prevent operation with the supply fans off.

vii. Vent fan operation should be monitored by airflow, not motor operation.

viii. P & P test and maintenance procedures should be provided.

(7) AC Motor Circuits.

(a) Tables.

i. 3-Phase, 208 VAC Branch Circuit Quick Reference Table (Figure 3-10).

ii. 3-Phase, 460 VAC Branch Circuit Quick Reference Table (Figure 3-11).

(b) Code Letters And Branch Circuit Protection.

i. General. The nameplate on a motor rated at 0.5 horsepower or larger must list its code letter (see 46 CFR 111.25-5 and NEC 430-7; this information is very seldom available to the plan reviewer). Code letters are listed alphabetically and represent the locked rotor kilo volt amperes (KVA) per horsepower. The branch circuit protective device chosen must be large enough to allow sufficient time for the motor to start. Higher code letters indicate greater locked rotor currents, requiring larger protective devices. When starting a motor with full voltage, the locked-rotor current does not diminish until the motor is very nearly up to its rated speed. Most motors used have code letters ranging from "F" to "V." For these motors, the maximum rating or setting of the branch circuit protective device, if a fuse, is 300 percent of the motor full-load current; if a circuit breaker, this value must not exceed 250 percent (see 46 CFR 111.70-1 and NEC Table 430-152). The minimum value is not given but must be capable of carrying the starting current of the motor (see subparagraph 3.C.2.g.(3) and NEC 430-52). For vital systems, however, a minimum of 200 percent full-load current is recommended for motors having "F" to "V" code letters, to ensure starting of the motors. The safety of the vessel far outweighs the motor circuit protection in any emergency situation. Use the trip setting values listed in the Quick Reference tables (Figure 3-10 or 3-11), Columns I or J as applicable, to check all motors having code letters "F" through "V."

ii. Motor Running Protection. Running protection for most motor applications is provided by circuit overload elements that take longer to operate but may be set closer to the recommended overload value of 115 percent of the motor's full-load current. The size of the device chosen must be determined from the actual nameplate

3.B.2.b(7)(b) ii. (cont'd) full-load current rating. This information is not available to the plan reviewer and sometimes even the design engineer. The marine inspector should compare the overloads used against the actual nameplate data to ensure that they do not exceed the 115 percent recommended value. Use the values listed in Columns "C" and "D" of Quick-Reference Tables (Figure 3-10 or 3-11), to check the maximum value to be specified for running protection. For additional methods, refer to NEC 430-C.

iii. Motor Controllers Or "Starters".

a. These devices are used to manually or automatically start electric motors from a local or remote location. Motor controllers basically consist of a relay or "contactor," which is used to connect the motor to the AC line by a pushbutton switch, liquid level switch, pressure switch, temperature switch, etc. The two types of controllers used are "low voltage release" (LVR) and "low voltage protection" (LVP). Both types can be identical controllers, but their electrical circuits will vary.

b. LVR controllers are required for vital systems to ensure that the equipment will re-start following a loss of power or reduction in voltage below the "drop-out" value of the operating coil. These starters are usually energized by contacts that must remain closed for the contactor to stay energized.

c. LVP controllers are activated by "momentary" contacts, such as a pushbutton. When the button is depressed, the starter is energized as above, but an additional "auxiliary" normally open contact furnished as part of the controller closes when the "starter" main contacts close. This contact is wired in parallel with the pushbutton and takes its place when the button is released, thus keeping the controller energized or "sealed-in." Should a momentary loss of power and accompanying drop in voltage occur, the starter coil will release all its main and auxiliary contacts and will not re-start following a power outage until the momentary pushbutton contact is again depressed.

d. The above discussion has been limited to the most commonly used method of starting electric motors on marine vessels; that is, by using the same AC source that powers the motor to energize its controller. In certain special applications, AC motor starters could be energized with DC or separate AC sources. Motor controllers are furnished with the thermal overload elements mentioned above. These elements are used to open

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d. (cont'd) (or close) contacts which are used either in the control circuit or to provide an overload alarm to another circuit. Some of these elements are adjustable; most often the non-adjustable type is specified. Most motors are stopped by contacts when an overload occurs to vital systems, such as steering, these devices are used only to signal the overload condition in a separate circuit.

iv. Disconnecting Means. Motor controllers are required with a disconnecting device mounted within the same enclosure. The disconnecting means must disconnect both the motor and controller from all supply conductors (see NEC 430 part IX).

v. Reference Tables.

FIGURE 3-10

3-PHASE, 208 VAC MOTOR CIRCUIT QUICK-REFERENCE TABLE FOR SINGLE BANKED CABLES

A	B	C	D	E	F	G	H	I	J
HP	FLA	Running Prot. 115% FLA.		Starter Size	Disconnect Size	Max. Full Volt Start	Prot. Device		
		Adj.	Non-Adj.			Code	B-E	Code	F-V
						C.B. 200%	Fuse 250%	C.B. 250%	Fuse 300%
.25	1.23	1.41	2	00	30	15	15	15	15
.33	1.48	1.7	2	00	30	15	15	15	15
.5	2.0	2.3	3	00	30	15	15	15	15
.75	2.8	3.22	4	00	30	15	15	15	15
1	3.6	4.14	4	00	30	15	15	15	15
1.5	5.7	6.56	8	00	30	15	15	15	15
2	7.8	8.97	10	0	30	20	20	20	20
3	10	11.5	12	0	30	20	30	30	30
5	17	19.6	20	1	60	35	40	50	60
7.5	24	27.6	30	1	60/100	50	50	70	80
10	31	35.7	40	2	100	70	70	90	100
15	46	52.9	60	3	100/200	100	100	125	150
20	59	67.9	70	3	200	125	125	150	200
25	75	86.3	100	3	200/400	175	175	200	250
30	88	101	110	3	200/400	200	200	125	300
40	114	131	150	4	400	250	250	300	350
50	143	164	200	4	400/600	300	300	400	450
60	170	196	225	5	400/600	350	350	500	500
75	212	243	250	5	600	500	500	600	—
100	273	314	350	5	600	600	600	—	—
125	343	394	450	6	—	—	—	—	—
150	396	455	500	6	—	—	—	—	—
200	528	607	800	6	—	—	—	—	—

FIGURE 3-10 (cont'd)

3-PHASE, 208 VAC MOTOR BRANCH CIRCUIT QUICK-REFERENCE TABLE

HP	K	L	M	N	O	P
	125% FLA	THREE CONDUCTOR BRANCH CABLE				
		AWG (IEEE 45, 50°C)			TSGA - ( )	
		T	E,X	AVS	40°C	50°C
.25	1.54	14	14	14	4	4
.33	1.85	14	14	14	4	4
.5	2.51	14	14	14	4	4
.75	3.5	14	14	14	4	4
1	4.5	14	14	14	4	4
1.5	7.13	14	14	14	4	4
2	9.75	14	14	14	4	4
3	12.5	14	14	14	4	4
5	21.3	12	14	14	9	9
7.5	30.0	10	10	12	9	9
10	38.8	7	8	10	9	14
15	57.5	5	6	7	23	23
20	73.8	3	4	5	30	30
25	93.8	1	2	3	40	50
30	110.0	1/0	1	2	50	60
40	142.5	3/0	2/0	1/0	75	100
50	178.8	4/0	3/0	2/0	125	125
60	212.5	300	250	4/0	150	150
75	265.0	400	350	250	200	250
100	341.3	600	500	400	300	400
125	428.8	—	—	—	400	—
150	495.0	—	—	—	—	—
200	660.0	—	—	—	—	—

FIGURE 3-11

3-PHASE, 460 VAC MOTOR BRANCH CIRCUIT QUICK-REFERENCE TABLE

A	B	C	D	E	F	G	H	I	J
HP	FLA	Running Prot. 115% FLA		Starter Size	Disconnect Size	Max. Full	Prot. Device Volt Start		
		Adj.	Non-Adj.			Code C.B. 200%	B-E Fuse 200%	Code C.B. 250%	F-V Fuse 300%
.5	1	1.15	2	00	30	15	15	15	15
.75	1.4	1.61	2	00	30	15	15	15	15
1	1.8	2.07	3	00	30	15	15	15	15
1.5	2.6	2.99	3	00	30	15	15	15	15
2	3.4	3.91	4	00	30	15	15	15	15
3	4.8	5.52	6	0	30	15	15	15	15
5	7.6	8.74	10	0	30	20	20	20	25
7.5	11	12.65	15	1	30/60	25	30	30	35
10	14	16.1	20	1	30/60	30	35	35	45
15	21	24.15	25	2	60/100	45	60	60	70
20	27	31.05	35	2	60/100	60	70	70	90
25	34	39.1	40	2	100/200	70	90	90	110
30	40	46	50	3	100/200	90	100	100	125
40	52	59	60	3	200	125	150	150	175
50	65	74.75	80	3	200	150	175	175	200
60	77	88.55	90	4	200/400	175	200	200	250
75	96	110.4	125	4	400	200	250	250	300
100	124	142.6	150	4	400	250	350	350	400
125	156	179.4	200	5	400/600	350	400	400	500
150	180	207	225	5	600	400	450	450	600
200	240	276	300	5	600	500	600	600	—

FIGURE 3-11 (cont'd)

HP	K	L	M	N	O	P
	125% FLA	THREE CONDUCTOR BRANCH CABLE				
		AWG (IEEE 45, 50°C)			TSGA -( )	
		T	E,X	AVS	40°C	50°C
.5	1.25	14	14	14	4	4
.75	1.75	14	14	14	4	4
1	2.25	14	14	14	4	4
1.5	3.25	14	14	14	4	4
2	4.25	14	14	14	4	4
3	6	14	14	14	4	4
5	9.5	14	14	14	4	4
7.5	13.75	14	14	14	4	4
10	17.5	14	14	14	4	9
15	26.25	10	10	12	9	9
20	33.75	8	10	10	9	9
25	42.5	7	8	8	14	14
30	50	6	7	7	14	23
40	65	4	5	6	23	23
50	81.25	2	3	4	30	40
60	96.25	1	2	3	40	50
75	120	2/0	1/0	1	60	75
100	155	3/0	2/0	1/0	100	100
125	195	250	4/0	3/0	125	150
150	225	300	250	4/0	150	200
200	300	500	400	300	250	300

(c) Examples of 3-Phase AC Motor Circuits. Use Quick-Reference Columns, Figure 3-10:

i. Example No. 1. Single motor, 25 horsepower, 460V, code letter J, full voltage start, non-vital, non-adjustable overloads, branch circuit protected by circuit breaker, Type T, IEEE 45 Cable, in 50°C ambient temperature space.

From Quick-Reference Columns, Figure 3-11:

D - Standard overload size nearest 115 percent full load; current is 40 amperes.

E - Starter size is 2.

F - If a disconnect is used near the motor, a 100 ampere size is sufficient, provided it is not fused above 100 amperes (if fusible). If part of a combination starter, the complete unit must be rated to handle the 25-horsepower motor.